



# AUTOMATIC MODULE TEST SYSTEMS

- MODULAR CONSTRUCTION
- VERSATILITY
- COMPLETELY PROGRAMMABLE
- EXPANDABLE
- COMPACT

Series 4600

## APPLICATIONS

### TESTING OF:

- Fast Transistor
- Fast Diodes
- Computer Switching Circuits
- Magnetic Devices
- Integrated Circuits

The system is based on GASL 4600 Series of modular instruments that are designed to be combined into a wide variety of systems for nanosecond testing. Such systems can be manual, automatic, and/or programmed test systems for diodes, transistors integrated circuits, logic cards, etc.

Each system is tailored to a specific requirement by selecting only those modules needed to build up that system. If the requirement should change in the future, additional modules could be added and the original modules replaced. As more sophisticated modules are developed, operating systems can be up-dated.

Maintenance is simplified and down-time reduced by utilizing standard modules, most of which are of plug-in design. Complete modular subassembly construction of many of the more complicated instruments in this group, such as the Model 120 AR-P Programmable Rack Mounted Sampling Oscilloscope, minimizes the spare parts cost by eliminating the need for the complete instrument.

### 1. GENERAL SYSTEM DESCRIPTION

The major components of any system are the GASL 120 AR-1 Programmable Sampling Oscilloscope, and companion 4600 Series modules, a Model No. 2305-P Pulse Generator, a Model No. 2440-P Automatic Waveform Reader, a Model No. 2510-P Dual Limit Comparator a Model 2540-P Normalizing high pass switching matrices as required and programming control.

A typical system operates as follows:

The Programmer can initially select the desired drive and load circuits, the input and output connections through the matrix, the oscilloscope gain and sweep settings, and the Go-No Go limits.

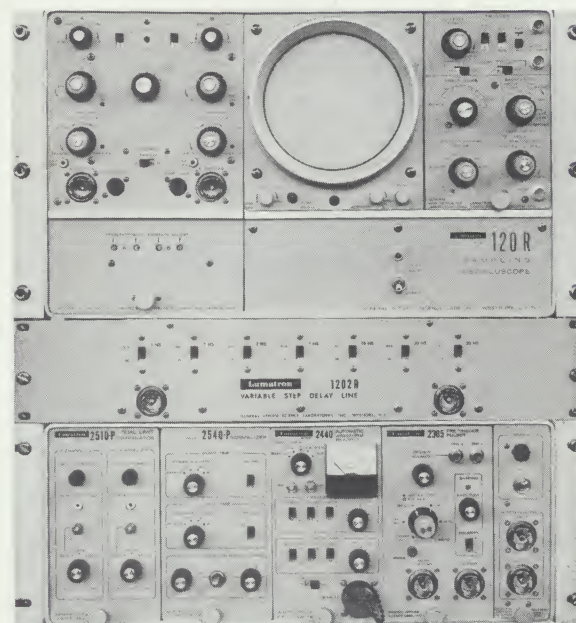
The Pulser, Model No. 2305P, signal is routed through the selected drive circuit and matrix to feed the circuit under test. The output drives the selected load circuit. The 120 AR-1 Sampling Oscilloscope, Channels A and B, sample the input and output signals respectively. The processed signals feed the Model 2440 Automatic Waveform Reader which performs the actual measurement, as commanded by the Programmer. The Model 2440 feeds the Model 2510, Dual Limit Comparator. The Go- No Go reference input to the Model 2510 is set by the Programmer for each test. The Go- No Go signal is available to control an external test jig handler.

Also available is a visual readout and the digital printout of the test results.

### A. PROGRAMMER CONTROL:

The Programmer Control can contain two Card Readers, one for test type select and one for module type and the control logic to direct the sequence of operations.

The test select card reader can program the test type to be performed and select the correct ranges and limits for the programmable modules. A typical Programmer can read a 12 x 80 card and is capable of selecting 12 different type tests.



The Component Type Card Reader programs the sequence of the tests to be performed on a selected circuit. For example, assume a rise time measurement is programmed to test an 8 input NAND/NOR gate. The same test must be performed eight times, once for each input, independent of the remaining inputs. The Component Type programmer controls the sequencing of the Test Type Programmer and the switching matrix to enable the system to perform these test steps. A separate card is required for each type of circuit.

The Control Logic processes the programmed data to control the operating of the Tester through the checkout sequence.

### B. OPERATING MODES:

#### a) Manual Mode:

Set by control pushbuttons.

##### ... Test Advance

... One step at a time, no test being performed, to the test type desired.

##### Single Test:

... Generates a single test of the test type selected as above.

The test data is available visually and in a digital readout code.

#### b) Automatic Mode:

... Permits stepping through all tests and generate Go-No Go signals and/or quantitative data as explained below.

##### Automatic Mode 1 - High Speed Go-No Go Testing.

The Tester automatically, without external control, steps through all programmed tests and positions and generates Go - No Go signals for each mode.

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#### Automatic Mode 2 - Data Log

... Same as Mode A, above, except that the test steps are at a slower rate to permit data logging of the quantitative test results.

#### C. DRIVE AND LOAD CIRCUITS:

To permit realistic testing of the circuit under actual operating conditions, the input pulser signal is shaped by a "drive" circuit and the circuit output drives a "load" circuit. The drive and load circuits could be modules of the same family type being tested. These circuits can be designed by the customer and mounted on GASL Model 2120 Test Cards, which in turn are mounted on the Model 1540 Test Fixture.

#### D. SIGNAL AND BIAS POWER SOURCES:

A typical pulse generator is the GASL Model 2305 Programmable Pulser. The frequency can be set at any rate (0 to 100K) and the amplitude programmable over any range up to 40 volts.

Programmable power supplies can permit the setting of bias voltages for each test step as programmed. The programming range typically is from 0V to  $\pm 20V$  up to currents of 0.5 Amperes.

#### E. SWITCHING MATRIX:

A typical Switching Matrix is the GASL Model 1820 High Frequency Input-Output Matrix, capable of providing multiple high frequency connections to circuits with less than 1 ns RT.

The Model 1820 is a matrix designed to connect nanosecond input drive pulses and power supplies to a multi-lead device or sub-assembly, such as an integrated circuit. It also provides connection to the output for measurement or display on a sampling oscilloscope or automatic sampling systems (such as the GASL 4600 Series Automatic Modular Test System).

All connections are coaxial using BNC connectors. For a typical 5x20 Matrix, any of 5 input-output connections can be made to any 5 of 20 device connections. \*The Matrix bandpass is 500 mc or approximately equal to a 0.7 ns risetime. A 0.8 ns RT pulse is degraded typically to 1 ns RT. The Matrix control is remote, requiring nominally 12V DC to actuate the relays required to complete 5 high frequency paths for a 5x20 Matrix, or two relays for each high frequency path.

The Model 1820 Matrix consists of many miniature dry reed switch elements, specially selected and mounted to provide maximum bandpass with minimum crosstalk or feed through. The Matrix has an impedance of 50-100 ohms nominally. A 5x20 Matrix contains a total of 200 relays.

#### F. PROGRAMMABLE OSCILLOSCOPE AND ACCESSORIES

The input and output signals at the matrix are sampled by the 120 AR-1 oscilloscope. The sampled signal is displayed on the CRT and fed to the Model 2440 Automatic Waveform Reader.

The actual measurements of the pulse parameters are made by the Model 2440 Automatic Waveform Readout Plug-In in conjunction with the Model 2540 Normalizer Unit. The Model 2440 Plug-In is programmed to read either time or amplitude. The standard Model 2540 Normalizer provides the 10% - 50% and 90% level signals to the Model 2440 which performs the commanded measurement; e.g. rise time 10% of pulse amplitude to 90% of pulse amplitude. If it is desired that measurements be made to start and/or stop at any voltage value on the waveform, the 100% and 0% points of the waveform (available from the Normalizer) can be fed to the External Test System. In turn, the Test System must feed back voltages corresponding to the desired percent levels for the start and stop points. The output of the Model 2440 is displayed on its front panel meter and is also available as a DC voltage - calibrated 0V to 10V corresponding to 0 cm to 10 cm deflection. The scale factor of the Model 2440 output voltage (volts/nanosecond, etc.) is determined by the scale, horizontal and vertical, of the 120A oscilloscope. This is a function of the programmed inputs.

The Model 2440 output feeds one input of the Model 2510 Dual Limit Comparator. The reference input is derived from the programmed input which selects the desired Go - No Go limit. The Model 2510 Go - No Go output is a level that is available for external sorting equipment that selects the correct bins for the tested module.

#### 2. DATA OUTPUT:

The Go - No Go limit signal is always available for all test modes. It is also indicated by "Failure" lamps on the Model 2510 Dual Limit Detector.

The quantitative data can be displayed by a Digital Volt-meter and simultaneously feed a printer. The printer data can contain as a minimum, measured value, measurement units (nanoseconds, volts, etc.), type measurement (rise time, etc.), number of device being tested, pass or fail.

The printer data can be generated for all tests except for High Speed Go - No Go testing. In addition, the operator can have an "Inhibit" control to prevent the printer from recording data for any mode.

#### 3. TEST CAPABILITIES:

A Switching Time Tester can perform the following tests under programmed control.

- ... Delay Time
- ... Rise Time
- ... Storage Time
- ... Fall Time
- ... Propagation Delay Time
- ... Pulse Width
- ... Pulse Amplitude
- ... D.C. Level

The time measurements are programmable to either 10%, 50%, or 90% points with the start and stop points independently programmed.

Voltages corresponding to 0% and 100% levels are available external controls.

#### SPECIFICATIONS:

##### a) OPERATION:

A typical system can operate either fully automatic mode or with manual control over all operations. Programming can be accomplished by two card readers that control relays in the programmable modules.

##### b) OUTPUT:

- ... Is a 3-digit visual indication of the measured data.
- ... Output lines (BCD) with decimal point to drive an external printer.
- ... Two output lines; one for GO and the second for NO-GO.
- ... Levels are 0V true and -8V false.

##### c) ZERO AND ONE HUNDRED PERCENT LOCATION:

- ... The Tester selects the 0% point of the input waveform in the first centimeter of the scope travel.
- ... The 100% point location is programmed to select the waveform value in the 10 cm for rise and fall time measurements and in the mid-range (adjustable) for pulse width measurements.

##### d) ACCURACY TIME MEASUREMENTS:

- ... The accuracy of the time measurements is within  $\pm 3\%$  of reading,  $\pm 1\%$  of full-scale over the full deflection capability of the 120AR-1 scope.
- ... The range of the oscilloscope is .5 nanoseconds to 1 millisecond full-scale.

##### e) PULSE AMPLITUDE:

- ... RANGE:  
Six ranges of 40 millivolts, 80 millivolts, 160 millivolts, 400 millivolts, 800 millivolts, and 1.6 Volts full scale.
- ... ACCURACY:  
 $\pm 3\%$  of reading
- ... MEASUREMENT POINTS:  
Normally fixed points but can be programmed.

##### f) TEST TIME:

The time per test step is the sum of:

- ... Programming relays switching time
- ... Test measurement time
- ... Test measurement readout - Go - No Go

The total time for one test step is approximately 40 milliseconds with 50% of the time due to the programming relay switching. The overall time to make a series of tests may be reduced by performing two or more tests at the same time. For example, pulse width and pulse amplitude can be performed at the same time with the addition of a Model 2440 and Model 2540 Plug-In modules. Depending on the relative time measurements, it may be possible to perform three tests at the same time with the addition of a third Model 2440, Model 2540, and a Model 2510. These additional options can be added to the system with minor changes required to the programmer to accommodate them.

The data-logging mode, the test time of approximately 40 milliseconds per step, is less than the time required for digital readout and printer outputs to be generated. In the data logging mode, the maximum rate could be under 100 milliseconds per step using a high speed printer.

#### CONSTRUCTION:

The equipment is modular with all major functional units rack mountable in a standard 19-inch rack, less than 26 inch depth, and height approximately 5 feet.

#### POWER REQUIRED:

The primary power for the system is single phase, 60 cycles AC between 115V,  $\pm 5\%$  RMS. Approximately 10 amperes of current will be required.

\*Other series available on special order.

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